

DEPARTMENT OF ENERGY
FY 2002 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

ADVANCED RESEARCH

I. **Mission Supporting Goals and Objectives:**

The Advanced Research Program (formerly Advanced Research and Technology Development) funds two types of activities. The first is a set of crosscutting studies and assessment activities in environmental, technical and economic analyses, coal technology export and international program support. The second is a set of crosscutting fundamental and applied research programs which include coal utilization science, materials and components, bioprocessing of coal and university-based coal research. The second set of programs includes an activity focused upon Historically Black Colleges and Universities (HBCU) and other minority institutions and addresses the full spectrum of fossil utilization research and development, technology transfer, outreach, and private sector partnerships.

In the crosscutting studies and assessments subprograms, the thrusts of international program support, environmental activities, coal technology export, and technical and economic analysis are to complement and enhance all Fossil Energy endeavors by providing both financial and technological leverage. International involvement is limited to those selected areas where it has been determined that the U.S. will benefit at least to the extent it contributes. FE, through these activities, always attempts to encourage the leveraging of research and development funds while promoting U.S. industrial interests and to use them as opportunities to achieve responsible international consensus and opinion on technical business assessment and policy issues.

The crosscutting fundamental and applied research programs focus upon developing the technology base in the enabling science and technology areas that are critical to the successful development of both superclean, very high efficiency coal-based power systems and coal-based fuel systems with greatly reduced or no net emissions of CO₂. These systems are encompassed in the Vision 21 energyplex. Advanced Research seeks a greater understanding of the physical, chemical, biological and thermodynamic barriers to achieving economic, technologic, and environmental goals and to identify ways to overcome those barriers. The program is unique in that it is directed to specific underlying fundamental scientific and engineering problems closely connected to short-term, mid-term and

I. **Mission Supporting Goals and Objectives:** ADVANCED RESEARCH (Cont'd)

long-range Fossil Energy objectives.

In order to achieve these goals, an Advanced Research focus area on Computational Energy Sciences was established at the National Energy Technology Laboratory (NETL). This focus area will conduct simulations and modeling activities to produce a “technology base” from which the energy plants of the future will be designed, built and operated.

The Coal Utilization Science subprogram focuses on research pertinent to all coal utilization systems, with specific attention paid to increasing our knowledge of the principal mechanisms that control coal combustion processes. It will address issues affecting the utilization of coal, and its primary thrust is in support of the development of the Vision 21 concept. It will involve novel concepts for CO₂ capture and sequestration, such as mineral carbonation, and virtual simulations and modeling of components and subsystems. It will also include research on instrumentation and diagnostics to support the need for advanced controls and sensors. High performance advanced materials and equipment are essential to advanced coal technologies. Thus, the thrust of the advanced materials subprogram is to develop advanced gas separation and particulate removal technology, as well as to develop solutions to materials performance barriers unique to very high temperature, highly corrosive coal combustion and gasification environments. Exploratory research and innovation to maximize the use of coal in environmentally preferable ways is typified by the bioprocessing of coal subprogram. The focus of the biotechnology program is to conduct biological research to produce clean fuels and to reduce greenhouse gas emissions (NO_x, SO_x, and CO₂) from existing and new powerplants. The thrust of the university coal research and HBCU education and training subprograms is to support competitively awarded research grants to U.S. universities to address Fossil Energy's highest priority research needs.

The major goal of the Advanced Research Program focus is to develop, by 2015, a series of advanced materials, subsystem technologies, and breakthrough process concepts that are essential to the success of Vision 21.

FY 2002 Performance Measures in furtherance of the above goals include:

- Develop solid oxide fuel cell electrolyte materials that operate at lower temperatures (650-800°C), thereby reducing fuel cell operating costs and decreasing corrosion of component parts.
- Provide between 15 and 20 grants to teams of university students and professors to perform research ranging from fundamental

I. **Mission Supporting Goals and Objectives:** ADVANCED RESEARCH (Cont'd)

studies in coal science and utilization, to long range exploratory research that could lead to future breakthroughs.

- Provide between 5 and 7 grants to teams of students and professors at minority institutions.
- Implement computational study of device-level experimental investigation of a critical Vision 21 component.
- Prepare detailed engineering assessments to design pounds/hour CO₂ mineral sequestration unit.
- Complete research efforts to determine alternate sources and processes for Mg and Ca as potential feedstock for CO₂ sequestration via mineral carbonation.
- Demonstrate that biohydrogen generation using extremophiles can be conducted on a production scale.

II. A. **Funding Schedule:**

<u>Activity</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>\$Change</u>	<u>%Change</u>
Coal Utilization Science	\$6,150	\$6,236	\$6,250	\$14	0%
Materials	6,821	6,985	7,000	15	0%
Technology Crosscut					
Coal Technology Export	845	843	800	-43	-5%
Bioprocessing of Coal	1,350	1,347	1,350	3	0%
Environmental Activities	2,000	1,996	1,900	-96	-5%
Technical & Economic Analyses	750	748	750	2	0%
International Program Support	1,000	998	950	-48	-5%
Focus Area for Computational Energy Science	<u>0</u>	<u>6,993</u>	<u>3,000</u>	<u>-3,993</u>	<u>-57%</u>
Subtotal, Technology Crosscut Research	5,945	12,925	8,750	-4,175	-32%
University Coal Research	2,921	2,993	3,000	7	0%
HBCUs, Education and Training	<u>974</u>	<u>998</u>	<u>1,000</u>	<u>2</u>	<u>0%</u>
Total, Advanced Research	<u>\$22,811</u>	<u>\$30,137</u>	<u>\$26,000</u>	<u>\$-4,137</u>	<u>-14%</u>

II. B. **Laboratory and Facility Funding Schedule:** ADVANCED RESEARCH (Cont'd)

	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>\$Change</u>	<u>%Change</u>
Argonne National Lab (East)	\$982	\$978	\$988	\$10	1%
Idaho Ntn'l Engineering & Environmental Lab	570	570	570	0	0%
National Energy Technology Laboratory	2,600	9,563	5,720	-3,843	-40%
Los Alamos National Lab	600	600	600	0	0%
Oak Ridge National Lab	3,923	4,044	4,435	391	10%
Pacific Northwest Lab	840	840	770	-70	-8%
Sandia National Laboratories	550	550	550	0	0%
Ames National Laboratory	140	140	230	90	64%
All Other	<u>12,606</u>	<u>12,852</u>	<u>12,137</u>	<u>-715</u>	<u>-6%</u>
Total, Advanced Research	<u>\$22,811</u>	<u>\$30,137</u>	<u>\$26,000</u>	<u>\$-4,137</u>	<u>-14%</u>

III. **Performance Summary:**

<u>Activity</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Coal Utilization Science	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research toward the Virtual Demonstration Plant. Conduct systems analysis of Vision 21 concepts to identify critical research areas. Implement projects to develop critical enabling	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research toward the Virtual Demonstration Plant in support of the Vision 21 power and fuels complex. Continue development of instrumentation, diagnostics and controls for	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research for and conduct preliminary model testing and research for Virtual Demonstration Plant. Continue development of instrumentation, diagnostics and controls for advanced power

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Coal Utilization Science (Cont'd)	technologies for advanced power and fuel systems in support of Vision 21 and incorporate the results into the Virtual Demonstration. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Continue research on mineral sequestration of CO ₂ . (\$6,087) (NETL, SNL, MIT, TBD)	advanced power systems. Conduct systems analysis of Vision 21 concepts to identify critical research areas. Continue projects to develop critical enabling technologies for advanced power and fuel systems and in support of Vision 21; and incorporate the results into the Virtual Demonstration. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Continue research on mineral sequestration of CO ₂ at large scale (1 kg). (\$5,924) (NETL, SNL, LANL, TBD)	systems. Continue stochastic modeling and systems analysis of Vision 21 concepts. Continue with six projects selected under the Vision 21 solicitation and issue new solicitations to develop critical enabling technologies for advanced power and fuel systems and in support of Vision 21. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Continue research on mineral sequestration of CO ₂ at large scale (1 kg) utilizing a full scale flow loop. (\$5,937) (NETL, SNL, LANL, Natl. Fuel Cell Res., Fluent, Reaction Engineering, TBD)
	No activity. (\$0)	Initiate collaborative efforts with Basic Energy Science on the Strategic Simulation Initiative to develop a new generation of combustion simulation	Continue collaborative efforts with Basic Energy Science on the Strategic Simulation Initiative to develop a new generation of combustion simulation

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

<u>Activity</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		computational models. (\$250) (TBD)	computational models. (\$250) (TBD)
Coal Utilization Science (Cont'd)	Fund technical and program management support. (\$63)	Fund technical and program management support. (\$62)	Fund technical and program management support. (\$63)
	\$6,150	\$6,236	\$6,250
Materials	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; and non- destructive evaluation techniques. (\$5,516) (ANL, INEEL, ORNL, PNNL)	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; and non- destructive evaluation techniques, high- and very-high temperature intermetallics, and oxide- dispersion-strengthened alloys. (\$5,474) (ANL, INEEL, ORNL,	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; non-destructive evaluation techniques, high- and very-high temperature intermetallics, and oxide- dispersion-strengthened alloys. (\$5,015) (ANL, INEEL, ORNL,

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

<u>Activity</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
		PNNL)	Eltron, Ames, Huntington Alloys, NETL)

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Materials (Cont'd)	Continue breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. (\$1,235) (TBD)	Increase support to breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. (\$1,441) (AMES, NETL, SNL, TBD)	Support development of alloys for supercritical systems. Increase support to breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. (\$1,915) (LANL, SNL, ORNL, PNNL, ARC, TBD)
	Fund technical and program management support. (\$70)	Fund technical and program management support. (\$70)	Fund technical and program management support. (\$70)
	\$6,821	\$6,985	\$7,000
Technology Crosscut - Coal Technology Export	Sustain continued support to deploy cleaner coal and power generation systems internationally. Continue pursuit of opportunities identified by the World Energy Council Working Group on the Strategic Value of Cleaner Fossil Fuel Systems for the international	Sustain continued support to deploy cleaner coal and power generation systems internationally. Pursue opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy Board for the international	Sustain continued support to deploy cleaner coal and power generation systems internationally. Intensify the pursuit of opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Technology Crosscut - Coal Technology Export (Cont'd)	sale of U.S. clean coal technologies and advanced power systems; and maintain efforts to develop collaborative environmental partnerships among major developing nations, U.S. states and local governments, NGO's and industry to support regional efforts to promote the increased use of cleaner power systems. Preserve the efforts in the Pacific Rim including sharing best practice information with utilities. (\$845) (TBD)	sale of clean technologies and advanced power systems. Promote deployment of cleaner energy systems through training, conferences, and information and technical exchanges on cleaner power systems. (\$843) (TBD)	Board for the international sale of U.S. clean coal technologies and advanced power systems. Expand the establishment of effective partnerships to advance U.S. interests in environmental protection by promoting deployment of cleaner energy systems through training, conferences, site visits and information and technical exchanges on clean power systems, best practices, privatization with targeted utilities and governments and advising countries on identification and elimination of barriers for deployment of cleaner coal and power systems. (\$800) (TBD)
	\$845	\$843	\$800
Technology Crosscut - Bioprocessing of Coal	Develop biological processes to reduce CO ₂ production and to sequester CO ₂ . Complete evaluation of electro-chemically	Develop biological processes for fuels that have a significantly lower unit content of greenhouse gas than currently available fuel to reduce	Develop biological processes for fuels that have a significantly lower unit content of greenhouse gas than currently available fuel to reduce

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Technology Crosscut - Bioprocessing of Coal (Cont'd)	<p>supplied electron carriers in synthesis gas fermentations. Develop biofiltration for removal of NO_x from combustion gases. Completed lab-scale testing of specific microorganisms to control zebra mussels. Develop biological CO₂ sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO₂ mitigation strategies such as whittings and ocean scale algae sequestration. (\$1,336) (ORNL, INEEL, TBD)</p> <p>Fund technical and program management support. (\$14)</p> <p>\$1,350</p>	<p>the impact on global climate change. Continue development of biofiltration for removal of NO_x from combustion gases. Initiate larger scale batch testing of toxins from microorganisms to control zebra mussels. Develop new biomineralization techniques for carbon sequestration. Continue to develop biological CO₂ sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO₂ mitigation strategies such as whittings and ocean scale algae sequestration. (\$1,333) (ORNL, INEEL, TBD)</p> <p>Fund technical and program management support. (\$14)</p> <p>\$1,347</p>	<p>the impact on global climate change. Complete development of biofiltration for removal of NO_x from combustion gases. Conduct field tests to develop toxin to safely control zebra mussels. Continue to develop biological CO₂ sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO₂ mitigation strategies such as whittings and ocean scale algae sequestration. (\$1,336) (ORNL, INEEL, U. State of NY, Cal. State U., TBD)</p> <p>Fund technical and program management support. (\$14)</p> <p>\$1,350</p>
Technology Crosscut - Environmental	Continue analyses of issues associated with air and water quality, solid waste disposal, and	Continue analyses of issues associated with air and water quality, solid waste disposal, and	Continue analyses of issues associated with air and water quality, solid waste disposal, and

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Activities	toxic substances, and global climate change. Continue emission trends and forecast studies.	toxic substances, and global climate change. Continue emission trends and forecast studies.	toxic substances, and global climate change. Continue emission trends and forecast studies.
Technology	(\$1,800) (ANL, ICF, Resource Dynamics, TMS, PNNL, TBD)	(\$1,796) (ANL, ICF, Resource Dynamics, TMS, PNNL, TBD)	(\$1,710) (ANL, ICF, Resource Dynamics, TMS, PNNL, TBD)
Crosscut - Environmental Activities (Cont'd)	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. (\$200) (TMS)	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. (\$200) (TMS)	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. (\$190) (TMS)
	\$2,000	\$1,996	\$1,900
Technology	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog"	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog"	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog"
Crosscut - Technical and Economic Analysis			

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Technology Crosscut - Technical and Economic Analysis (Cont'd)	technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. (\$750) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)	technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. (\$748) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)	technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. (\$750) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)
	\$750	\$748	\$750
Technology Crosscut - International Program Support	Support Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Preserve active relationships with international organizations such as the World Energy Council (WEC) and United States Energy Association (USEA). Implement Environmental Corps activities in conjunction with the U.S., China Energy and Environmental Center function. Initiate cleaner energy technology activities in Russia, Newly Independent States	Continue support of Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade associations, and the energy industry. Preserve and enhance active relationships with national and international organizations such as the World Energy Council (WEC), United States Energy Association (USEA), Southern	Continue support of Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade associations, and the energy industry. Preserve and enhance active relationships with national and international organizations such as the World Energy Council (WEC), United States Energy Association (USEA), Southern

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Technology Crosscut - International Program Support (Cont'd)	formerly of the Soviet Union and Southern and Western regional African countries. Assessment and assistance of near and middle east, other regions and U.S. Industry-International Outreach. Determine opportunities for power systems in targeted countries. (\$1,000) (TBD)	States Energy Board (SSEB) and the National Association of State Energy Officials (NASEO). Implement Environmental Corps activities in China and activities of the U.S.-China Energy and Environmental Center. Focus on expanding cleaner energy technology power systems activities in Southern and Western regional African countries, Eastern Europe, the Pacific Rim, Russia and Newly Independent States, South Asia/Near East, Western Europe, and the Western Hemisphere. Determine opportunities for power systems in targeted countries. (\$998) (TBD)	States Energy Board (SSEB) and the National Association of State Energy Officials (NASEO). Focus on expanding cleaner energy technology power systems activities in Southern and Western regional African countries, Eastern Europe, the Pacific Rim, Russia and Newly Independent States, South Asia/Near East, Western Europe, and the Western Hemisphere. Determine opportunities for power systems and clean fuels from coal in targeted countries. (\$950) (TBD)
	\$1,000	\$998	\$950
Technology Crosscut - Focus Area for Computational Energy Science	No activity. (\$0)	Enhance NETL capabilities to model and conduct dynamic simulations of advanced energy plants. Establish a consortium with industry, national labs and regional	Continue developing NETL's capabilities to model and conduct dynamic simulations of advanced energy plants. Complete advanced modeling tools for sub-elements in

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
Technology Crosscut - Focus Area for Computational Energy Science (Cont'd)		universities and collaborate with other DOE programs for simulation, materials, fabrication/manufacturing research. Expand scientific simulation and computational capability at NETL through installation of a high speed computer data line located at the Supercomputing Center. Complete the conversion of basic and applied science models into a supercomputing environment and conduct runs of simulations to verify codes.(\$6,923) (NETL)	turbines and fuel cells. Continue advanced development of combustion dynamics, pollution formation and separations computational tools. (\$2,970)
	No activity. (\$0)	Fund technical and program management support. (\$70)	Fund technical and program management support. (\$30)
	\$0	\$6,993	\$3,000
Technology Crosscut, Subtotal	\$5,945	\$12,925	\$8,750
University Coal Research	Support grants at U.S. universities which emphasize longer-term research that will accelerate technology development and	Support grants at U.S. universities which emphasize longer-term research that will accelerate technology development and	Support grants at U.S. universities which emphasize longer-term research that will accelerate technology development and

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
University Coal Research (Cont'd)	<p>identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; and increase the number of critical key research areas to include global climate change. Collaboration through joint proposals involving university and industry teams will continue. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. (\$2,851) (TBD)</p>	<p>identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; and increase the number of critical key research areas to include global climate change. Collaboration through joint proposals involving university and industry teams will continue. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. (\$2,923) (TBD)</p>	<p>identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; continue to support critical key research areas to include Vision 21, global climate change, materials, sensors and controls, and by-products from coal. Continue collaboration through joint proposals involving university and industry teams, and teams with three or more universities. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. Award Phase 2 grants to last year's most meritorious innovative concept grantees. (\$2,930) (TBD)</p>
	Support the undergraduate	Support the undergraduate	Support the undergraduate

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

Activity	FY 2000	FY 2001	FY 2002
University Coal Research (Cont'd)	internship program to allow those junior-level science and engineering majors to experience fundamental research in the areas of environmental science and engineering, and energy, where no graduate course or degrees are offered in their major field of study. (\$40) (TBD)	internship program to allow those junior-level science and engineering majors to experience fundamental research in the areas of environmental science and engineering, and energy, where no graduate course or degrees are offered in their major field of study. (\$40) (TBD)	internship program to allow students having science and engineering majors to perform fundamental research in the areas of environmental science and fossil energy, where no graduate course or degrees are offered in their major field of study at their institutions. (\$40) (TBD)
	Fund technical and program management support. (\$30)	Fund technical and program management support. (\$30)	Fund technical and program management support. (\$30)
	\$2,921	\$2,993	\$3,000
HBCUs, Education and Training	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. (\$964) (TBD)	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. (\$988) (TBD)	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. (\$990) (TBD)
	Fund technical and program management support. (\$10)	Fund technical and program management support. (\$10)	Fund technical and program management support. (\$10)
	\$974	\$998	\$1,000
Advanced			

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd)

<u>Activity</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Research, Total	\$22,811	\$30,137	\$26,000